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UNEDITED ROUGH DRAFT TRANSLATION

A METHOD FOR MEASURING SMALL AND LARGE COEFFICIENTS OF REFLECTIONS AT SUPER-HIGH FREQUENCIES

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SOURCE: Byulleten' Izobreteniy, Patent No. 131800, No. 18, 1960, pp. 24-25.

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OF REFLECTIONS AT SUPER-HIGH FREQUENCIES

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Methods are known for measuring small and large reflection coefficients on the shf band; these are based on determination of the position of the standing-wave node to the left of the irregularity with movement of a short-circuited piston to the right of it, and determination of the VSWR value from the obtained data. The disadvantage of such methods is their difficulty, since many readings must be made during the measurement process.

In the described method this is eliminated by the fact that the irregularity in a small VSWR is connected to a traveling-wave resonator which has variable coupling with the waveguide, the irregularity with a large VSWR is connected to the main waveguide, and the VSWR of the irregularities are determined from the readings of the measurement line in the main waveguide and from the coefficient of the connection between the waveguide and the traveling-wave resonator, when the latter is at resonance.

As explanation of the described method, Fig 1 shows a diagram of the instrument for measuring small reflection coefficients ($VSWR < 1$), and Fig. 2 shows that for large coefficients ($VSWR > 10$).

The shf-energy source 1 is connected to main waveguide 2, loaded with matched load 3. The traveling-wave resonator formed by wave-guide sectors 4, 5, 6, phase

converter 7, and directional coupler 8, is connected, by means of the coupler, to main waveguide 2. The connection between the main waveguide 2 and the resonator can be varied by regulating coupler 8. When measuring small reflection coefficients the investigated irregularity 9 is coupled to the traveling-wave resonator instead of waveguide sector 5 of the frequency of the shf oscillations generated by source 1, and the phase shift created by phase converter 7 is selected such that the electrical length of the waveguide loop of the resonator equals a whole number of wavelengths. The value of the coupling of main waveguide 2 with the resonator is selected using coupler 8 such that the condition $| \rho_1 | < \frac{| C |^2}{2 - | C |^2}$ is satisfied, here ρ_1 is the reflection coefficient of the measured irregularity 9, and C is the coupling coefficient of waveguide 2 to the traveling-wave resonator. Measuring the VSWR in the main waveguide, from the readings of the measurement line (not shown in the figure), we find the value of the reflection coefficient of the measured irregularity from the formula

$$| \rho_{in, max} | = \frac{| C |^2 | \rho_1 |}{2 - | C |^2 - 2 \sqrt{(1 - | \rho_1 |^2) (1 - | C |^2)}},$$

where $\rho_{in, max}$ is the input reflection coefficient (in the main waveguide) at resonance. When measuring large VSWR, the measured irregularity 9 is coupled to the main waveguide ahead of matching load 3, the value of the connection between main waveguide 2 and the resonator is established such that an easily and conveniently measureable value of the VSWR at the main waveguide input $| \rho_{in, max} |$ is obtained, and the reflection coefficient $| \rho_1 |$ is determined for the investigated irregularity 9 from the formula

$$| \rho_{in, min} | = \left[\frac{\sqrt{1 - | C |^2} - l^{-\alpha}}{1 - \sqrt{1 - | C |^2} \cdot l^{-\alpha}} \right] \cdot | \rho_1 |,$$

where l is the base of natural logarithms, and α is the attenuation in the resonator, in nepers.

Object of the Invention

This method of measuring small (VSWR < 1.1) and large (VSWR > 10) reflection

coefficients on super-high frequencies has the following special feature: to decrease the difficulty in making measurements, the irregularity with a small VSWR is coupled to a traveling-wave resonator which has variable coupling to the waveguide, the irregularity with large VSWR is coupled to the main waveguide, and the VSWR of the irregularities is determined from the readings of the measurement line in the main waveguide and from the coefficient of the connection between the waveguide and the traveling-wave resonator when the latter is at resonance.

